## ZOÖLOGY.

THE ORIGIN OF FRESH-WATER FAUNAS, A STUDY OF EVOLUTION. —Under this title Professor W. J. Sollas read a paper at a late meeting of the Irish Royal Society, which is reported in *Nature* for June 12. As no reference has been made apparently to work done in this country, it will supplement Dr. C. A. White's essays on the same subject. The poverty of fresh-water faunas as compared with marine is commonly attributed to a supposed inadaptability on the part of marine organisms to existence in fresh-water. That this explanation is inadequate is shown by the existence of fresh-water jelly-fish, such as Limnocodium, and still more directly by the experiments of Beudant, who succeeded in accustoming several kinds of marine mollusca to a fresh-water habitat. The view of Von Martens that the severity of a fresh-water climate is prohibitive of the existence of most marine forms in rivers is insufficient, and a more thoroughgoing explanation is necessary. This is to be found in a study of the means by which the distribution of marine animals is secured. In the case of stationary forms free-swimming embryos are distributed over wide areas by currents, and they can never pass from the sea into rivers, in which the current is always directed seawards. Nor, probably could an attached form once introduced into a river permanently establish itself so long as its propagation took place exclusively through free-swimming larvæ, for these would gradually be borne out to sea. Hence, fresh-water animals should not, as a rule, pass through a free larval stage of existence, nor, as a matter of fact, do they. In Hydra, fresh-water sponges, and Polyzoa, the young usually emerge from a horny cyst in the complete state. In the Unionidæ, the glochidium stage provides for distribution without involving a seaward journey. The young of fresh-water mollusks do not enter upon a free existence until they are similar to their parents, and Paludina is viviparous. The suppression of a free-swimming larval stage not only occurs in fresh-water, but in many marine invertebrates. This is connected with the fact that the larval stage is in a position of disadvantage as compared with the adult. Hence there is an advantage to the organism if the larval stage can be passed over in a state of seclusion. From this various other modifications follow; development in seclusion involves a supply of accessible food, hence the appearance of yolk, and other kinds of nourishment furnished by the parent to the imprisoned embryo. Again, the secluded larva being spared the drudgery of working for its own existence, and supplied with nutriment in a form that puts the least tax on its digestive powers, a larger balance of energy remains available for metamorphic changes. Thus arise the phenomena of accelerated and abbreviated development. Further, the shortening of the larval life probably leads to the lengthening of the adult life, and shifts the

chances of variation and selection forward into the adult stage. Thus animals which hatch out in a complete state will most probably suffer modifications of that state, and not of previous ones, except very indirectly. Here we discover a direct tendency towards a mode of development which explains the "arborescent" character of our zoölogical classifications, *i. e.*, the tendency of the tree of life is now to produce leaves rather than new branches. In the case of fresh-water fauna very direct reasons have existed for the suppression of the free larval stage. In this connection may be noticed the richness in species and the poverty in genera of the fresh-water mollusca. In discussing the origin of fresh-water faunæ, there are three hypotheses from which we have to select: (1) That marine forms have immigrated into rivers; (2) that they have migrated into marshes and thence into rivers; and (3) that marine areas have been converted into fresh-water ones. The last course has been the most usual, especially in the case of non-locomotive forms. Hence the origin of fresh-water invertebrates is connected with the great movements which have affected the earth's crust. The earliest well known lacustrine areas are those of the old red sandstone, in one of which we meet with the earliest known fresh-water mollusk, *Anodonta jukesii* (Forbes). The lakes of the Permo-Triassic period contributed additions to the fresh-water fauna of the globe. The Neritidæ and Melaniidæ are so closely connected with them they may be regarded as their collateral or direct descendants, and thus may have originated in Triassic lakes, but not earlier. Other genera probably arose at the same time; the occurrence in Cretaceous deposits of Unio, Physa, Valvata and Limnea in the Nearctic, Palæarctic, and Oriental regions, suggests a high antiquity for these genera; and they may have existed in Palæozoic times. The lakes of the Tertiary period furnished probably further contributions to our fresh-water fauna, such as Lithoglyphus and Dreissena. Thus, existing fresh-water genera are probably descended from marine forms which became metamorphosed in the waters of the Devonian, Triassic, and Tertiary lakes. In the lakes of Central Africa the Tertiary fresh-water fauna still survives, nearly all of the genera from Lake Tanganyika being referable to genera already in existence in Mesozoic and Tertiary times. The lakes of the northern hemisphere received on subsiding beneath the glacial sea such Arctic forms as *Mysis relicta* and *Pontoporeia affinis*, but most of their existing inhabitants have re-entered them since their emergence from the sea.

Shells of Anticosti.—When leaving Ottawa in the summer of 1883 to study the flora of Anticosti, Professor Macoun promised me that he would endeavor to make as complete a collection as possible of the land and fresh-water shells of that little known island. The result of his labors is most gratifying, and shows that they were energetically and intelligently directed. His col-

lection was some time since placed in my hands for determination, and I have now much pleasure in submitting a list of the shells to the many students of science who take an interest in the distribution of the Mollusca.

Land Shells: *Helix hortensis* Müll.; *Macrocyclis concava* Say; *Hyalina nitida* Müll.; *Patula striatella* Anthony; *Conulus fulvus* Drap.; *Vallonia pulchella* Müll.; *Helicodiscus lineatus* Say; *Vitrina limpida* Gould; *Cionella subcylindrica* L.; *Pupa muscorum* L.; *P. pentodon* Say; *P. hoppii* Möller; *Vertigo gouldii* Binney; *Succinea obliqua* Say; *S. ovalis* Gould; *S. avara* Say; *S. verrilli* Bland.

Fluviatile Shells: *Limnæa stagnalis* L.; *L. palustris* Müll.; *L. emarginata* Say; *Physa heterostropha* Say; *Bulinus hypnorum* L.; *Planorbis bicarinatus* Say; *P. campanulatus* Say; *P. deflectus* Say; *P. parvus* Say; *Valvata sincera* Say; *Pisidium abditum* Hald.; *Anodonta fragilis* Lamarck.

Professor Macoun was informed that a large kidney-shaped mussel occurred in Fox river—a locality which he was unable to visit. This shell no doubt is *Margaritana margaritifera*—already recorded from Anticosti by Professor Alpheus Hyatt. *Acanthinula harpa* Say, was not observed, although from being found on the mainland opposite, in Gaspé, and inward along the St. Lawrence to Montreal, its presence might be expected. Both the plain and banded forms of *H. hortensis* were collected, but none of var. *nemoralis*. *Vallonia pulchella* is the strongly ribbed variety (*costata* Müll.), which has not, I believe, been found elsewhere in Canada, where the typical form is very common, but which is known to occur at various points in the United States. *Succinea verrilli* does not seem distinguishable from *S. avara*, otherwise than by its want of the protective covering so characteristic of the latter shell. The Limnæa referred to *emarginata* is somewhat doubtful, but is probably that species. The Anodonta is quite distinct from the pale, thin forms of *fluviatilis* which it is the custom to call *fragilis*, and probably more nearly approaches Lamarck's species—originally described from Newfoundland—than any shell found in the interior region. It will be observed that the list includes nearly all the shells which are common to America and Europe. Of these *Conulus fulvus* has the most extended distribution north and south, while others of them—*Cionella subcylindrica*, *Patula striatella*, *Bulinus hypnorum*, *Limnæa stagnalis* and *L. palustris*—range with it across Canada to Vancouver island. —*Frank R. Latchford, Ottawa, Ont.*

Gill on the Habits of Fishes.—Professor Gill gives the following notes in a late number of *Forest and Stream*: "We have an interesting instance of the female of one type of catfish found in South America, the Aspredinidæ, in which there occur periodical swellings of the skin of the abdomen in which the eggs are received, and therein they are nourished for some time. Again

in the same group, or order of catfishes, but in another family, the Arii, the male parent takes care of the eggs by holding them in his mouth, and so preserving them from danger very skillfully. Care is taken of the young by other species of the family. It was with great interest that some months ago Mr. Ryder and myself observed the habits of our common catfish. The male hovered over the young, and when feeding, frequently took the young into his mouth, but always ejected them again, thus discriminating accurately between the objects taken as food, and the young fish accidentally transferred to his mouth. This same habit of taking care of the young in the mouth is exhibited by certain Cichlids, forms somewhat like, and perhaps akin to, our common sunfishes. One of these is a fish found in the Holy Land, a species of Chromis. And the same peculiar habit is likewise manifested by species of the same family living in South America, the Geophagi. The belief was also long current, and found expression in most of the old books, that fishes not only did not take care of their young, but were invariably oviparous. We all know now how false such a statement is. In one class, the Selachians, the larger proportion of forms are viviparous. For example, of the sharks proper, three-fourths or more are viviparous, and the same statement holds good with respect to the rays or skates. Thus, out of 150 species of rays, over 100 are viviparous, and another noteworthy fact is that the oviparous rays are nearly all included in one family—the common skates or rays brought to our markets. This feature of viviparity was known to the ancient naturalist, Aristotle, who went even so far as to say that the Selachians were viviparous, while all scaly fishes were oviparous. There, however, he erred, for there is no such limitation. Many of the Selachians are oviparous, and, on the other hand, many of the scaly fishes are viviparous. For instance, all the Embiotocoids are viviparous, and of these the common perch of the Pacific is an example; also viviparous are the eelpout of our markets, and species of the Cyprinodont family among others. Viviparity is, indeed, largely manifested among fishes. The only reason why reverse statements are found in the old books is that in Europe these cases were almost unknown. I agree with the statement of Mr. Ryder that confinement frequently affects the power of procreation, either directly or indirectly, and this does not apply to fishes alone, as is evident from the experience of those in charge of menageries and zoölogical gardens. It is known that many animals and birds which are confined seem to live with perfect freedom in zoölogical collections, but they do not bring forth young, or their eggs are sterile. There are many exceptions to this rule, but many cases of sterility for which we can assign no other cause. Somewhat analogous is the peculiar pathological condition of animals living in confinement, in which the bones become softened or rickety."

HIBERNATION OF THE GRAY GROUND SQUIRREL.—On January 18, last, I was fortunate enough to have brought to me, by a farmer residing near here, a gray ground squirrel, *Spermophilus franklini* in the hibernating state.

The squirrel, or gopher, was rolled up in a perfect ball, his head resting forward of the root of his tail, and the tail curled carefully up on the body of the ball. The gentleman also brought with him about one-half of the nest in which the gopher was found, the gopher still resting in it. The nest was made of common lowland grass (cured), and was merely a nicely collected ball of hay without any sign of a place of entrance, but had instead every appearance as though some brother gopher had built the nest around the body of the hibernator. This ball of hay or nest, was about twelve or fourteen inches in diameter, and was found by the farmer and some workmen in a hay stack on his farm. The nest was in the center of the stack, which was large, and had stood in the field two years. No other nest was found. When the workman who was pitching hay from the stack, came to this ball of hay, he kicked it to one side, but the farmer considering it a strange discovery to find frozen hay in the center of such a large stack, though water run down into it, carried it home for examination, and in turn was so well pleased with the discovery of the sleeping marmot, that in his enthusiasm he brought the animal to me the next day; forgetting, by the way, to consider that a change of temperature might kill it, as he kept the animal exposed to the very cold freezing weather we had at that time, during the night and until noon the next day, the time of delivery to me. The animal when placed in my hands showed no signs of life, excepting in the healthy condition of the hair and soles of its feet; in this observation no one could deny that life existed, and that the animal was in perfect health. Anticipating that the sleeper would live, I prepared a cage, placed him in it, intending to test the various degrees of bodily heat-temperature as spring approached, and he was expected to awake from his winter's nap. His weight at this time was 15¾ ounces.

The weather increased in severity, and not having a place to keep him in, which I believed could be kept in as regular temperature as I supposed the haystack to have been, I placed it where I thought I could come the nearest to it; but in which I fear I must have failed, for upon examination after ten days in my possession I discovered that the gopher had withdrawn his nose from its pressure against his stomach, his tail did not hold the like position I had several times noticed during the ten days I had had it, his feet were withdrawn from their symmetrically laid position upon each side of the center of the junction of the neck and the hinder parts of the body, which the tail previously had so perfectly covered; the body was now limp, and there was evidence of a hemorrhage, having come through the mouth and

nostrils; but otherwise the appearance of the animal was as life-like as when I first saw it. At various times thereafter I examined it, but only to discover no change to prove that death had taken place, until about the 15th day of March, when I discovered that putrefaction had set in; the body was then disposed of.

The question with me now is, Did this gopher die upon his being changed from the temperature of the haystack to the excessive cold of the night and day following, or did he merely become affected sufficiently with the other changes that followed to produce hemorrhage, and in this reduced condition did he not then have vitality enough to carry him through the hibernating condition, and died because wanting this power?—*D. H. Talbot.*

THE VARYING HARE.—This species derives its name from the well-known circumstance that it changes color in spring and fall—being dark reddish-brown in summer and snowy white in winter. Concerning the method of the change much difference of opinion exists, and some of the ablest of recent writers pass the point in silence.

Pennant says: "These animals, at approach of winter, receive a new coat, which consists of a multitude of long white hairs, twice as long as the summer fur, which still remains beneath."[1] Dr. Richardson stated that, in his opinion, "the change to the winter dress takes place by a lengthening and blanching of the summer fur; whilst the change in the beginning of summer consists in the winter coat falling off during the growth of the new and colored fur." This opinion comes very near the truth, but does not express the whole truth. The first clause is absolutely correct; for in the fall the change certainly does occur "by a lengthening and blanching of the summer fur," the individual hairs changing color after the first fall of snow. This species, like the great majority of mammals, is clothed with two kinds of hair—a fine soft fur which densely covers all parts of the body, and longer, stiffer hairs, scatteed through, and projecting beyond the former. These long hairs are black in summer and white in winter. In the fall of the year, when the change begins, they become white at the tips first, the black gradually fading from above downwards, until the entire hair is white. In spring the process is reversed, the exposed portion of the long hairs becoming black (though the extreme tip sometimes remains white until the change is far advanced), which color gradually extends downward, at the expense of the white, until the entire hair is black. Sometimes the displacement of the white is temporarily interrupted, the two colors appearing in alternate zones. And during the latter part of March, when the body of the animal is still white, it is not uncommon to find hundreds of black hairs scattered over the back, many of them with the extreme apices, and a narrow zone between the middle and base,

[1] Arctic Zoology, Vol. I, 1792, p. 110. *Lepus americanus.*

white. In fall or early winter the soft fur becomes tipped with white, the white portion increasing somewhat in length and diameter. In spring a curious phenomenon takes place. The white portion of the fur loses its vitality, becomes brittle, and breaks off on slight friction, so that the animal, in brushing through the undergrowth, soon rids himself of it. As a rule the long hairs change first.[1] Both in spring and fall the time of the change seems to be governed by the presence or absence of snow, and is not affected by the temperature. It occurs independently of the moult, and the new hairs assume the prevailing color of the animal, or the color toward which it is tending at the time of their appearance.—*C. Hartt Merriam, from advance sheets of the Transactions of the New York Linnæan Society, Part ii.*

Food of Cats.—The note by Mr. Dimmock, of Cambridge, in the September number of the Naturalist, upon the food of cats, impels me to speak of my pet kitten. She refuses milk utterly if she can be supplied with anything else. She eats cooked green-corn with a relish. In this connection a friend informs me that he has frequently fattened cats this way. Indeed, they will steal the cobs out of swill pails. My kitten will catch and eat moths and the water bugs of the kitchen. Her patience in watching a moth outside the window-screen, the other night, gave me much amusement; she followed its every motion, and finally mounted to the top of a step-ladder and from thence made springs at the window. The moth was all unconscious of the very slight yet effective interposition of the screen.

I have known cats to eat clams to such repletion that they died. Fishing cats are by no means uncommon.—*W. W. Bailey, Providence, Aug. 25, 1884.*

On the remarkable Skull of an Idiot twenty-one years old.—In a communication to the Anthropological Society of Brussels, M. P. Albrecht proceeds still further in his work of suggesting fresh relationships among the bones of the skull. The basioccipital is, according to our author, primarily formed of two bones, the true basioccipital, which is the centrum to which the exoccipitals are the neurapophyses, and the *basiotic*, which is the centrum to which the periotics or petrosals are the neurapophyses. This imports an additional vertebra into the cranium, and makes the periotics a primary part of it, instead of an adaptation for the organ of hearing. Every bone of this malformed skull is thoroughly described and lessons of homology derived from it. The sketches of the right temporal of this idiot and of a horse

[1] Specimens in my museum, killed in Lewis county, December 1st, March 21st, and April 3d, well illustrate the above described conditions of pelage. In spring, while the change is in progress, the attachment of the white tips is so feeble that hundreds may be blown off at a single puff. The change occurs more or less irregularly over the greater part of the body, but is usually symmetrical on the head, giving rise to a very pretty pattern.

just born show the temporal divided into squamosal, quadrate and mastoid, while the malar is, in the idiot skull, divided by a vertical suture into a premalar and postmalar (post frontals, anterior and posterior). The "Japanese bone," formed by a horizontal suture, cuts off a hypo-malar, which M. Albrecht identifies with the *quadrato-jugal.*

This treatise, like all others from this investigator, deserves careful attention. However he may appear to controvert current theories, it cannot be denied that he is pointing out homologies between the bones of the mammalian skull and those of lower vertebrates, some of which have hitherto baffled morphologists.

Zoological News.—*General.*—In the fifth part of Archiv für Naturgeschichte, 1883, the work of the year 1882 in various departments of zoölogy is reviewed. The articles upon the mollusks and fishes are by Professor E. Von Martens. American work occupies a prominent position, especially in Ichthyology. The reviews of the progress in ornithology and mammalogy, are by Herr. V. Ant. Reichenow, and here again American work is conspicuous. Dr. Oskar Bœttger reviews the herpetology. As not only separate works, but all articles upon the various branches of zoölogy are mentioned, and as geographical distribution, palæontology, etc., are kept apart, these reviews will repay examination. The whole of the fourth part of the Archiv für Naturgeschichte for 1883 is occupied with a review of the progress made in entomology, carcinology, and in the knowledge of the Arthropoda generally during 1882. The reviewer is Dr. Ph. Bertkau, of Bonn.——Dr. El. Metschnikoff (Arb. aus dem Zoöl. Inst. der Univ. Wien., 1883) gives particulars of the intercellular digestion of invertebrates. The ectodermal digestion of sponges and polyps, and digestion through wandering mesodermal elements are shown to be an evidence of the descent of the Metazoa from colonies of Protozoa.

*Cœlenterates.*—Dr. Claus (Arb. aus dem Zoöl. Inst. Wien., 1883) describes the ephyra-stage of Cotylorhiza and Rhizostoma.

*Worms.*—M. G. Pruvot has, at Banyuls-sur-Mer, investigated the nervous system of the Eunicidæ, and finds: (1) That the cerebral mass is composed of two distinct parts; a cerebral and a stomato-gastric; (2) That the antennæ and sense-organs are supplied with nerves entirely from the cerebral center, and that the odd posterior antenna represents a pair of appendages that have united on the median line; (3) that the stomato-gastric center furnishes all the nerves of the palpi and the stomato-gastric connections; (4) That the stomato-gastric system has essentially the same disposition as the general nervous system; consisting of a sub-œsophageal center, an œsophageal ring, and a ventral chain, the latter consisting of at least two ganglia, the lowest of

which appears to be formed by the union of two.——M. Poirier and Rochebrune have carefully described *Lophobdella quatrefagesi*, a hirudinean which resides in the mouth of *Crocodilus vulgaris*, *cataphractus* and *leptorhynchus*, and also upon the lingual papillæ of *Gymnoplax ægyptiacus* and in the pouch of *Pelecanus crispus* and *onocrotalus*.

*Mollusks.*—Dr. Carl Grobben contributes to the Arbeiten aus dem Zoöl. hist. Univ. Wien, 1883, the results of his studies of the urinary and generative organs as well as of the body-cavity of the Cephalopoda.——Herr Von Vincenz Hilber (Sitz. der Kais. Akad. der Wiss. Wien, 1883) describes the land-snails of China, gathered by Ludwig V. Loezy, geologist of Count Szechenyi's expedition. Twenty species are detailed, of which eleven are given as new. The memoir is accompanied by a complete bibliography.

*Crustaceans.*—Dr. Wilh. Müller (Archiv. für Naturgeschichte 1884), contributes a memoir upon the Cytheridæ. He describes fully the male and female sexual organs, also the pair of appendages situated between the first locomotive limbs, and then catalogues the species found in the Baltic and North seas. Thirteen species, in eight genera, are enumerated, including *Cytherois virens*, nov. gen. and sp. In another article in the same issue Dr. Müller describes *Longipedina paguri*, a copepod which resides in the shell-habitation of *Pagurus bernhardus*.

*Reptiles.*—In the first part of the Archiv. für Naturgeschichte, 1884, Dr. J. V. Bedriaga gives a thorough description of two species of Amphisbæna, *cinerea* and *strauchi*, with enlarged figures of the heads of both, from above, below, and laterally. Numerous examples of *A. cinerea*, from various parts of Spain and Portugal, as well as from Morocco, were examined, and the species is said to occur at Constantinople, and also *A. strauchi*, the distinctness of which is evident, is common at Smyrna, when the specimens examined were collected, and Dr. Bedriaga believes that the *A. cinerea* that has been said by authors to occur in Rhodes, Cyprus, Magnesia, etc., and perhaps even that of Turkey and Greece may prove to be really *A. strauchi*. The skull and soft parts of Amphisbæna are fully described in the memoir.——The Egyptian Naja has been found in Tunis. A fine example $1.55^{m}$ long was taken by M. Valery-Mayet at the well of El-Aia.

*Mammals.*—M. Paul Albrecht, in a communication to the Anthropological Society of Brussels, describes the "vermian fossette" of the skull of mammals. He finds that this fossette, situated between the right and left cerebellar fossettes, and marked externally by a protuberance, is common to mammals in general. M. Albrecht has found it in the monotremes, marsupials, edentates, ungulates, Cetacea, Sirenia, Carnivora, Rodentia, Insectivora, bats, and most monkeys. The thickness of the skull

in ungulates prevents this central fossette from appearing as an eminence on the outside of the skull, and in the dolphins the crest between it and the cerebellar fossettes is not prominent, but the vermian fossette is absent only in the orang, chimpanzee, gorilla, and man. In all these it appears occasionally. It was first found in man by Cesare Lanbroso (1871), in the skull of a criminal, and has since been frequently noted in criminals, madmen, and inferior races, especially among the Aymara, whence it has been called the "aymarian fossette." Its occurrence in the higher apes and man must therefore be considered as a mark of atavism. ——Paul Reichart, writing from Mpala, on the west coast of Tanganyika, states that the Sako (Soko) is very common in that locality. A nest was found some five hundred meters from a village. It was about ten feet above the ground, resembled the nest of a large bird of prey, and was unprotected above. The Sako sets within the nest, not under it. A band of Sakos, from six to twenty strong, frequents the neighborhood of a village. Herr Reichart compares the cry of the Sako to that of man and wife when quarreling, and characterizes it as diabolical. Mingled with this are deep bass tones and cries deceptively like those of a child. The animal is about 1.3 meters (about four feet three inches) high, very strongly built. The natives fear him more than they fear the lion, so much so that they abandon a road if a band of these apes take up their abode near it. An example of the *Balæna cisarctica* was cast ashore at Taranto, southern Italy, in 1877, and another was captured at Guetaria, not far from San Sebastian, Spain, on February 11, 1878.——At the meeting of the Royal Microscopical Society, June 11, Mr. Hazlewood called attention to human spermatozoa with two tails.——M. Testut read a paper July 7, before the French Academy on the results of his dissection of a Bosjesman from twelve to fourteen years old. The muscular system was in a more or less rudimentary state, which exists in a normal condition in various anthropoid apes and monkeys, and in some instances even in mammals of other orders. M. de Quatrefages in his remarks attempted to point out that these facts supplied no fresh arguments in favor of man's descent from a Simian prototype.

## PHYSIOLOGY.[1]

THE CHOLERA BACILLUS.—The reports of the commissions under the direction of Dr. Koch, sent by the German government to Egypt and India to investigate the cause of the cholera epidemic, are of great scientific and practical interest. It was attempted early in the research to find some bacterial organism whose presence was peculiar to the disease. This was long-tried in vain, chiefly on account of the large number of diverse forms of bacteria found in the intestines of cholera patients. But finally

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.